# CUSTOMER RELATIONSHIP MANAGEMENT SYSTEMS

CRM (Customer relationship management) is an interaction model that believes that the center of the entire business philosophy is the client, and the main activities are measures to support effective marketing, sales and customer service.

**A CRM system** is a corporate information system designed to automate a company's CRM strategy, in particular, to increase sales, optimize marketing, and improve customer service by storing information about customers and their relationship history, establishing and improving business procedures, and then analyzing the results.

It is important to distinguish between a CRM strategy as such and a CRM system as a technological tool for implementing this strategy.

The CRM system includes the following functional elements:

1. Sales Force Automation (SFA);
2. Marketing Automation (MA);
3. Customer Service and Support (CSS).

The basis of the CRM system is sales automation applications. They are assigned the following functions:

 maintaining a database of clients with extended details (recording comprehensive information about the counterparty);

 fixing the history of interaction with each client in the database;  maintaining a calendar of events and planning work;

 organization of the sales process (creation and distribution of a list of potential customers, registration of calls and requests, acceptance of orders);  maintenance of customer orders, preparation of commercial proposals;  monitoring and forecasting potential sales;

 generation of reports, including specialized reports;

 automation of mobile sales (transfer of information in the mode  real-time via mobile devices to remote employees) , etc.

In modern CRM systems, SFA applications are supplemented with marketing automation tools that allow you to:

 organize marketing campaigns, track their effectiveness (there are tools for planning, developing, conducting and analyzing the results of marketing campaigns, including Internet campaigns);

 create target audience groups, conduct segmentation of the client base;  create direct mass mailing of information and other materials;

 maintain a marketing knowledge base containing information about products, services, prices, competitors.

Customer service automation applications have recently become of paramount importance, because in a highly competitive environment, it is possible to keep a profitable customer, first of all, thanks to the high quality of service. CSS applications allow you to:

 record requests from the client and monitor the progress of applications within the company;

 maintain a knowledge base-a directory of typical and common problems and their solutions;

 control the execution of service agreements (automatic tracking of terms and conditions), management of warranty/contract services.

Automation of standard functions of sales, marketing and service departments can significantly increase the productivity of their activities. What is specific to CRM systems is that these functions are not just automated, but become part of a single client-oriented system. Each interaction takes place in the context of the entire history of the client's relationship with the company, which can be used to provide additional services.

Improvement of this kind directly reduces costs, increases revenue and profits. Qualitatively developed and implemented CRM program allows you to:

 to gather together the most important information about each client and the history of the development of relations with him the company;

 identify target customers of the company and develop special marketing programs to increase their loyalty;

 develop a personal set of individual products and services of the company for each client;

 improve the efficiency of each Department and reduce the unit costs per client and trade operation; provide faster and more accurate work with potential customers

 customers, prompt action on customer requests;

 virtually eliminate the possibility of loss of the client, due to dissatisfaction with the service;

 analyze customer needs and make long-term and strategic plans for production;

 organize and issue reports of any level of complexity on the current and future activities of the company;

 create a detailed and accurate picture of the work of the marketing Department for product sales for the company's management;

accurately and quickly respond to changes in market conditions

At the moment, almost any modern CRM system has more or less all the above capabilities and levels of information processing. Examples of Western CRM systems are mySAP CRM, Microsoft Dynamics CRM, Siebel eBusiness CRM, ACT!

**Expert system – (ES, expert system**)-an information system that can replace a specialist expert in solving a problem situation. Expert systems began to be developed by artificial intelligence researchers in the 1970s, and received commercial reinforcement in the 1980s.

Typical applications of expert systems include such tasks as medical diagnostics, localization of equipment faults, and interpretation of measurement results. Expert systems must solve problems that require expert knowledge in a particular field to solve them. In one form or another, expert systems must have this knowledge. Therefore, they are also called *knowledge-based systems*.

However, not every knowledge-based system can be considered an expert system. An expert system must also be able to *explain* its behavior and decisions to the user in some way, just as a human expert does. This is especially necessary in areas that are characterized by uncertainty, inaccuracy of information (for example, in medical diagnostics). In these cases, the ability to explain is needed in order to increase the user's confidence in the system's advice, as well as to enable the user to detect a possible defect in the system's reasoning. In this regard, expert systems should provide friendly interaction with the user, which makes the process of reasoning of the system "transparent" for the user».

Often, expert systems have an additional requirement-the ability to deal with uncertainty and incompleteness. Information about the task may be incomplete or unreliable; the relationship between the objects of the subject area may be approximate. For example, it may not be entirely certain that the patient has a symptom or that the measurement data is correct; the drug *may* cause a complication, although this usually does not occur. In all these cases, reasoning using a probabilistic approach is necessary.

Expert systems are considered together with knowledge bases as models of behavior of experts in a certain field of knowledge with the use of logical inference and decision-making procedures, and knowledge bases - as a set of facts and rules of logical inference in the selected subject area of activity. In response to the simplest queries, expert systems give the values "true" or "false" depending on the availability of relevant facts. Responses to complex queries are generated using inference rules that act as definitions of concepts, as well as logical procedures that consist of sets of inference rules.

In other words, the knowledge base consists of facts (static information about the subject area) and rules of analysis and information processing procedures (a set of instructions that can be applied to known facts to get new facts). The expert system analyzes the situation and, depending on the direction, makes recommendations for solving the problem.

The knowledge base of the expert system is created with the help of three groups of people:



system;



experts of the problem area, which includes the tasks solved by this expert

knowledge engineers who are specialists in the development of

information systems;

 programmers who implement the expert system.

The main advantage of expert systems is the ability to accumulate knowledge and preserve it for a long time. Unlike a person, expert systems approach any information objectively, which improves the quality of the examination. When solving problems that require processing a large amount of knowledge, the possibility of an error in the search is very small.

Let's highlight the following advantages of an expert system over a human expert:

1. Expert systems are more objective and do not have biases;
2. Expert systems work in a systematic way, looking at all the details, often choosing the best alternative possible;
3. The knowledge base can be very, very large. Once entered into the machine, knowledge is preserved forever. A person has a limited knowledge base, and if the data is not used for a long time, they are forgotten and lost forever;
4. Knowledge-based systems are resistant to ―interference‖. The expert uses side knowledge and is easily influenced by external factors that are not directly related to the task being solved. Expert systems that are not burdened with knowledge from other areas are inherently less susceptible to "noise".

On the other hand, it is obvious that the reliability of the generalized information depends on the availability of the necessary facts and the reliability of the data in the knowledge bases. In this regard, the most important property of information stored in knowledge bases is the reliability of specific and generalized information in the database and the relevance of information obtained using the inference rules embedded in the knowledge base. Therefore, even the best of the existing expert systems have certain limitations compared to the human expert:

1. Most expert systems are very difficult for the end user to use, and many of them are available only to those experts who created their knowledge bases;
2. The question-and-answer mode usually adopted in such systems slows down the decision-making process;
3. The complexity of bringing the knowledge obtained from the expert to the form that ensures their effective machine implementation.
4. Expert systems are not applicable in some subject areas and in areas where there are no experts (for example, in astrology).
5. When solving problems, an expert usually turns to his intuition or common sense, if there are no formal methods of solving or analogues of such problems. Expert systems do not have common sense, so they are designed to be a tool in the hands of the expert, and not to replace it.

#### Business intelligence systems.

Business intelligence (BI) systems are information systems designed to generate reports and analyze information about the activities of an enterprise and

its environment while working on tasks related to making decisions based on actual data. BI systems also include tools used to transform, store, model, deliver, and trace information. Biotechnologies allow you to analyze large amounts of information, focusing users ' attention only on key performance factors, modeling the outcome of various actions, tracking the results of making certain decisions. With this class of IP, decision-makers must obtain the right information at the right time, using the right technologies.

Other possible and frequently encountered translations of the term into Russian are business analysis and data mining.

Using financial analysis programs allows an organization to:

 speed up and simplify the process of obtaining forecasts of the financial situation at the enterprise. Computer technology allows you to perform complex mathematical calculations in the shortest possible time, and eliminates the "human factor" - errors that can be made by a person through inattention.

 have prepared on a single methodological basis options for the consequences of management decisions. The use of a complex of computer models will allow to form a single strategy of financial management at the enterprise and is an incentive to the formation of the analytical service of the enterprise as a single complete unit.

 optimize the process of processing and obtaining the necessary financial information. Data for analysis is exported from accounting programs, processed, and immediately issued a conclusion about the financial condition and forecast dynamics for the future, both in tabular form, and, as a rule, in the form of graphs and charts.

BI technology is based on the organization of end-user access and analysis of structured quantitative data and business information. BI generates an iterative process of the business user, including access to data and analysis, and thus the manifestation of intuition, the formation of conclusions, finding relationships to effectively change the enterprise in a positive way. BI has a wide range of users in the enterprise, including managers and analysts.

Today, BI-systems usually include the following tools: query and report generators, data mining tools, operational analytical processing tools (OLAP), and others.

**Query and report generators** are tools that provide users with access to databases, perform some analysis, and generate reports. Requests can be either unplanned or have a routine nature. Modern BI-systems have the ability to create mailings, publish reports on the Web, mechanisms for notification of events or deviations.

**Data mining** is the process of discovering hidden correlations, trends, patterns, relationships, and categories between variables in large arrays of raw data. It is performed by carefully examining data using pattern recognition technologies, as well as statistical and mathematical methods. During data exploration, various operations and transformations are performed repeatedly on

the raw data (feature selection, stratification, clustering, visualization, and regression), which are intended to:

1. to find ideas that are intuitive for people who, in turn, better understand the business processes that underlie their activities;
2. to find models that can predict the outcome or meaning of certain situations using historical or subjective data.

An important point of data mining is the no triviality of the wanted patterns. This means that the patterns found must reflect the non-obvious, unexpected regularities in the data that make up the so-called hidden knowledge.

Data mining tools allow you to solve the following tasks:

 classification-assignment of an input vector (object, event, observation) to one of the previously known classes;

 clustering-division of a set of input vectors into groups (clusters) according to the degree of "similarity" to each other;

 description reduction - for data visualization, laconism of models, simplification of counting and interpretation, compression of volumes of collected and stored information;

 Association-search for duplicate patterns. For example, the search for market basket analysis- along with beer often buy nuts;

 prediction;

 deviation analysis – for example, detecting atypical network activity can detect malware;

 visualization – visual representation of data to the user.

Online analytical processing (**OLAP,** real-time analytical processing) is an information processing technology that includes the compilation and dynamic publication of reports and documents. Used by analysts to quickly process complex database queries.

The reason for using OLAP for query processing is speed. Relational databases store entities in separate tables that are usually well normalized. This structure is convenient for operating databases, but complex multi-table queries are relatively slow to execute. A better model for querying, rather than changing, is a spatial database. OLAP takes a snapshot of the relational database and structures it into a spatial model for queries. The claimed processing time of queries in OLAP is about 0.1% of similar queries in a relational database.

An OLAP structure created from working data is called an OLAP cube. a Cube is created from joining tables using a star schema. In the center of the "star" is a fact table that contains the key facts for which queries are made. Multiple tables with dimensions are attached to the fact table. These tables show how aggregated relational data can be analyzed. The number of possible aggregations is determined by the number of ways in which the original data can be hierarchically displayed.

Note that unlike using OLAP, data exploration is much less user-directed, instead relying on specialized algorithms that establish the relationship of information and help recognize important (and previously unknown) trends, free

from user bias and assumptions. Data mining tools differ from OLAP tools in that instead of checking the expected interdependencies, they can produce models based on the available data to quantify the degree of influence of the studied factors. In addition, data mining tools allow you to create new hypotheses about the nature of unknown, but actually existing relationships in the data.

Table 14.1. Examples of problem formulations using OLAP and Data Mining

methods

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| *OLAP* | ***Data Mining*** |
| **What are the average injury rates for smokers and non-smokers?** | What factors best predict accidents? |
| **What are the average phone bills of existing customers compared to the accounts of former customers (who****refused the services of a telephone company)?** | What characteristics distinguish customers who, in all probability, are going to refuse the services of a telephone company? |
| **What is the average value of daily purchases on a stolen and non-stolen credit card?** | What are the characteristics of customers who are likely to refuse the services of a telephone company? |

In addition to these tools, BI can include the following analysis tools: statistical analysis and time series analysis and risk assessment packages; modeling tools; neural network packages; fuzzy logic tools and expert systems. In addition, it is necessary to note the means for graphic design of the results: the means of business and scientific and technical graphics; "dashboards", means of visualization of multidimensional data.

Despite the fact that the financial planning module with business intelligence systems has already been installed on MRP-II systems, many Russian enterprises prefer to use domestic developments of BI systems, which are better oriented to domestic business conditions. As an example of business intelligence systems, we note several developments "INEK-Analyst", "Audit Expert", Business Objects, Cognos, OLAP-services MS SQL Server, etc.

#### Electronic Document Management Systems

Documents are the main information resources of any organization, working with them requires correct formulation. Documents provide information support for management decision-making at all levels and accompany all business processes. Document flow is a continuous process of document movement that objectively reflects the activity of the organization and allows it to be managed quickly. Long search for the necessary document, losses, duplicates, delays in sending and receiving, staff errors are not a complete list of problems that arise in the inefficient construction of document flow. All this can greatly slow down, and in exceptional cases – completely paralyze the work of the organization.

Electronic document management systems (EDMS) form a new generation of enterprise automation systems. The main objects of automation in such systems are documents (in their broadest sense, from ordinary paper to electronic of any format and structure) and business processes, represented as the movement of documents and their processing. This approach to enterprise automation is both constructive and universal, providing automation of document flow and all business processes of the enterprise within a single concept and a single software tool.